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OF

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FOR

ABSORBENT ARTICLE WITH SEGMENTED AND SEPARATED ABSORBENT STRUCTURE

ABSORBENT ARTICLE WITH SEGMENTED AND SEPARATED ABSORBENT STRUCTURE

Background of the Invention

A typical absorbent article includes a liquid permeable top sheet, a liquid impermeable back sheet, and an absorbent core or structure disposed between the top sheet and back sheet. A user wears the absorbent article in the crotch area of an undergarment. Exudates, such as urine and menses, pass through the top sheet for absorption by the absorbent core, and the back sheet prevents any exudates from penetrating the absorbent article and reaching the undergarment. The user generally wears the absorbent article a single time and discards the article after a relatively short period of use.

The length, width, and thickness of the absorbent article depend on the particular application and intended user. Ideally, the absorbent article should fully cover the user's genital area, possess maximum fluid capacity, remain visually discrete from the outside of the undergarment, and minimize discomfort to the user. In practice, fully covering the user's genital area and possessing sufficient fluid capacity increases the length, width, and/or thickness of the absorbent article, resulting in an article that is less visually discrete from the outside of the undergarment and/or less comfortable to the user.

Various designs of absorbent articles exist to optimize the competing design considerations of coverage, capacity, visual discretion, and comfort. For example, U.S. Patent 6,160,197 discloses an absorbent article having an absorbent core positioned between a fluid-permeable cover and a fluid-impermeable baffle. The absorbent core further includes longitudinal flexure axes that permit the absorbent core to fold into a "W" shape when subjected to lateral compressive forces, such as the user's legs. In this manner, the absorbent core can be made wider to cover a larger area and possess additional fluid capacity, yet the absorbent core may collapse to a "W" shape when compressed to reduce the width and promote comfort.

U.S. Patent 5,514,104 discloses another attempt to improve the coverage and capacity of the absorbent core without sacrificing visual discretion or comfort. As disclosed in U.S. Patent 5,514,104, the posterior and/or anterior end of the absorbent article includes a notch. The notch permits that end of the absorbent article to conform to and move with the user's body, improving the article's visual discretion and improving the user's comfort.

Other geometries exist to improve the balance between coverage, capacity, visual discretion, and comfort by varying the geometry of the absorbent article and/or absorbent core, and the present invention provides another such geometry.

Summary of the Invention

Objects and advantages of the invention are set forth below in the following description, or may be obvious from the description, or may be learned through practice of the invention.

In one embodiment of the invention, a feminine care absorbent article includes a liquid permeable top sheet, a generally liquid impermeable back sheet peripherally joined to the top sheet, and an absorbent core between the top sheet and back sheet. The absorbent core includes a first longitudinal segment and a second longitudinal segment transversely separated from the first longitudinal segment. The absorbent article further includes a flexible zone between the first and second longitudinal segments, and the flexible zone has a reduced absorbency compared to the absorbent core. In a particular embodiment, the feminine care absorbent article may also include a transverse segment proximate to either or both ends of the first and second longitudinal segments.

In another embodiment, an absorbent article includes a liquid permeable top sheet, a generally liquid impermeable back sheet peripherally joined to the top sheet, a plurality of longitudinal absorbent segments between the top sheet and back sheet, and a flexible zone between the longitudinal absorbent segments. The flexible zone has a

reduced thickness compared to the longitudinal absorbent segments. In a particular embodiment, the absorbent article may also include a transverse segment proximate to either or both ends of the longitudinal segments.

An alternate embodiment of the present invention includes a liquid permeable cover, a generally liquid impermeable baffle peripherally joined to the cover, and an absorbent core between the cover and baffle. The absorbent core has a transverse axis with a stepped absorbent capacity and a stepped flexibility. The absorbent core may also have a longitudinal axis with a substantially constant absorbent capacity and a substantially constant flexibility.

In yet another embodiment, a feminine care absorbent article includes a liquid permeable cover, a generally liquid impermeable baffle peripherally joined to the cover, and an absorbent core between the cover and baffle. The absorbent core includes a first longitudinal segment and a second longitudinal segment transversely separated from the first longitudinal segment. The absorbent core has an extended position in which the first and second longitudinal segments are transversely separated by approximately 10 millimeters. The absorbent core also has a compressed position in which the first and second longitudinal segments are substantially together.

Those of ordinary skill in the art will better appreciate the features and aspects of such embodiments, and others, upon review of the specification.

Brief Description of the Drawings

A full and enabling disclosure of the present invention, including the best mode thereof to one skilled in the art, is set forth more particularly in the remainder of the specification, including reference to the accompanying figures, in which:

Figure 1 is a perspective view with partial cut-away of an embodiment of the present invention;

Figure 2A is a perspective view with partial cut-away of an embodiment of the present invention without any lateral compression;

Figure 2B is a perspective view with partial cut-away of an embodiment of the present invention under lateral compression; and

Figures 3, 4, and 5 are perspective views with partial cut-away of alternate embodiments of the present invention.

Detailed Description of Preferred Embodiments

Reference will now be made in detail to present embodiments of the invention, one or more examples of which are illustrated in the accompanying drawings. Each example is provided by way of explanation of the invention, not limitation of the invention. In fact, it will be apparent to those skilled in the art that modifications and variations can be made in the present invention without departing from the scope or spirit thereof. For instance, features illustrated or described as part of one embodiment may be used on another embodiment to yield a still further embodiment. Thus, it is intended that the present invention covers these and other such modifications and variations as come within the scope of the appended claims and their equivalents.

The present invention relates generally to an absorbent article **10** for intercepting and retaining body fluids or exudates. The accompanying figures depict the absorbent article **10** as a sanitary napkin for feminine hygiene having a conventional elongated oval shape; however, the absorbent article **10** may also be a panty liner, shield, diaper, training pants, adult incontinent garment, or any other disposable absorbent article known in the art. Moreover, the absorbent article **10** may have other shapes, such as hourglass or rectangular, and varying sizes and thickness, depending on the particular application.

Referring to Figure 1, the absorbent article **10** generally includes a top sheet or cover **20**, an optional transfer layer **30**, a back sheet or baffle **40**, and an absorbent core **50**.

The top sheet or cover **20** provides the absorbent article **10** with a liquid permeable surface that contacts the user's skin. The cover **20** should provide a comfortable, conforming interface with the user's skin by being flexible, compliant, and non-irritating to the skin. The cover **20**

should also transfer fluids quickly and remain dry and clean during use. In addition to being liquid permeable, the cover **20** may also include apertures **22** for freely passing exudates with minimal absorption. The cover **20** may be coated with a surfactant to further enhance permeability to the absorbent core **50** and reduce absorption by the cover **20**. The cover **20** may also include embossed channels **24** to create an aesthetically pleasing surface and further disperse exudates passing through the cover **20.**

The cover **20** may be any woven or non-woven material which passes body fluids yet remains comfortable to the user. Examples of suitable cover materials include rayon, bonded carded webs of polyester, polypropylene, polyethylene, nylon, or other heat-bondable fibers, polyolefins, copolymers of polypropylene and polyethylene, linear low-density polyethylene, and aliphatic esters such as polylactic acid. A specific example of a suitable cover material is a bonded carded web made of polypropylene and polyethylene such as that used as cover stock for KOTEX® panty liners and obtainable from Sandler Corporation, Germany.

The transfer layer **30** provides an optional layer between the cover **20** and the absorbent core **50.** When present, the transfer layer **30** wicks fluid passing through the cover **20** and disperses the fluid to the absorbent core **50**. The transfer layer **30** may comprise a fibrous blend of polyester, rayon, and a polymeric fiber such as that marketed by C. Itoh & Co. under the trademark CHISSO. For example, the transfer layer **30** may be 50 percent polyester fibers having a length of approximately three to six millimeters, approximately 30 percent straight rayon fibers having a length of approximately five to ten millimeters, and the balance CHISSO having a length of approximately five to ten millimeters.

The back sheet or baffle **40** may peripherally join to the cover **20** and provide the absorbent article **10** with a liquid impermeable and possibly vapor permeable surface that prevents exudates from completely penetrating the absorbent article **10** and soiling the user's undergarment. Ideally, the baffle **40** is soft, flexible, quiet, breathable, and may include

some absorbent capacity on the side facing the absorbent core **50**. The garment-facing side of the baffle **40** may include adhesive strips or other suitable fastening device (not shown) for adhering the absorbent article **10** to the user's undergarment. The baffle **40** may be any suitable material known in the art, such as embossed and non-embossed thermoplastic films, laminated tissue, and polyethylene films. In one embodiment, the baffle **40** includes a non-woven material laminated to a microporous film.

The absorbent core **50** provides the operative material for collecting and retaining body fluids or exudates while remaining light and dry feeling during use. The absorbent core **50** should be soft, not stiff, and should retain its shape, even when wet. The absorbent core **50** resides between the cover **20** and baffle **40** and may be attached to either or both layers to hold the absorbent core **50** in place and protect the absorbent core **50** from abrasion. The absorbent core **50** is typically approximately 2-10 millimeters thick and is oriented about a longitudinal axis **X** and a transverse axis **Y**.

The absorbent core **50** may be any structure or combination of components which are generally compressible, conformable, non-irritating to the user's skin, and capable of absorbing and retaining bodily fluids. For example, the absorbent core **50** may include an absorbent web of cellulose fibers, such as wood pulp fibers, other natural fibers, synthetic fibers, woven or non-woven sheets, scrim netting or other stabilizing structures, superabsorbent materials, binder materials, surfactants, selected hydrophobic and hydrophilic materials, pigments, lotions, and odor control agents, as well as combinations thereof. In one embodiment, the absorbent core **50** is a matrix of cellulose fluff coated with superabsorbent hydrogel-forming particles. The absorbent core **50** may be formed using various methods and techniques known in the art, such as dry-forming, air forming, wet-forming, and foam-forming, as well as combinations thereof.

Superabsorbent materials are well known in the art and may be selected from natural, synthetic, and modified natural polymers and materials. The absorbent core **50** generally includes superabsorbent

material, with the superabsorbent material ranging from about 0-90 percent by weight of the absorbent core **50**, depending on the application and desired absorbency. For example, the total absorbency may be about 200-900 grams of .9% by weight saline for infant care products; whereas, the total absorbency for adult care products may be about 400-2000 grams of .9% by weight saline. For feminine care products, the total absorbency may be within the range of about 7-50 grams of menstrual fluid.

Referring to Figures 1, 2A, and 2B, in one embodiment the absorbent core **50** generally includes two longitudinal absorbent segments **51, 52,** and a flexible zone **54** separates the two longitudinal absorbent segments **51, 52.** In this configuration, the longitudinal absorbent segments **51, 52** extend substantially parallel to the longitudinal axis **X** and occupy the outer edge of the absorbent article **10**. The longitudinal absorbent segments **51, 52** may vary in width and separation along the longitudinal axis **X** and generally have a combined width of absorbent material of approximately 10-50 millimeters. In particular embodiments, the longitudinal absorbent segments **51**, **52** may be thicker and/or more absorbent adjacent to the longitudinal axis **X** and/or at the transverse axis **Y**, with the thickness and/or absorbency decreasing as the longitudinal absorbent segments **51**, **52** extend away from the longitudinal axis **X** and/or the transverse axis **Y**.

In the embodiment shown in Figures 1, 2A, and 2B, the absorbent core **50** also includes a transverse absorbent segment **56** generally parallel to the transverse axis **Y**. The transverse absorbent segment **56** may occupy either or both ends of the absorbent article **10** and may be integral to the longitudinal absorbent segments **51, 52,** as shown, or separate from them. The transverse absorbent segment **56** generally has an absorbent width approximately equal to the sum of the widths of the longitudinal absorbent segments **51, 52** and the flexible zone **54,** although alternate embodiments within the scope of the present invention include transverse absorbent segments having shorter widths or widths as much as 150 millimeters.

The flexible zone **54** occupies the variable width in the absorbent core **50** between the longitudinal absorbent segments **51, 52** and generally aligns under the user's crotch when the absorbent article **10** is properly positioned. The flexible zone **54** generally comprises a minimally absorbent, highly flexible surface having a stepped reduction in thickness and absorbency compared to the absorbent core **50**, particularly as compared to the longitudinal absorbent segments **51**, **52**.

The flexible zone **54** is deformation-assisting. As used herein, the term "deformation-assisting" refers to a zone which is either "flexure-assisting" or "compression-assisting" or a combination of both. As used herein, the term "flexure-assisting" refers to a zone which will support no or minimal bending moment. As used herein, the term "compression-assisting" refers to a zone which will support no or minimal compressive loads.

Various metrics exist to characterize the deformation-assisting property of the flexible zone **54**. For example, ASTM 5650-97 (2000) "Standard Test Method for Resistance to Bending of Paper of Low Bending Stiffness" measures the flexure-assisting property. This specific method measures a bending moment of a construction. The lateral compression test described in WO 03/053315 "Absorbent Article with Stabilized Absorbent Structure Having Non-Uniform Lateral Compression Stiffness" provides a method to measure the compression-assisting property. This specific method measures the lateral compression stiffness of a construction.

Qualitatively, the flexible zone **54** generally possesses a lower value for some or all of these measurements when compared to the longitudinal absorbent segments **51**, **52**. As a result, the flexible zone **54** will preferentially bend, buckle, or compress before and/or to a larger degree than the longitudinal absorbent segments **51**, **52** when subjected to a compressive load.

Quantitatively, the measurements may provide a basis for determining, evaluating, and/or varying the effectiveness of the flexible zone **54**, depending on the particular application and desired functionality.

For example, in particular embodiments, a ratio of a specific measurement, such as the bending moment or maximum lateral compression force, of the flexible zone **54** compared to the same specific measurement of the longitudinal absorbent segments **51**, **52** may be less than one. Other particular embodiments may require a ratio that approaches values as low as 0.01.

The width of the flexible zone **54** varies according to the particular embodiment and intended use for the absorbent article **10**. In general, the flexible zone **54** has a width of approximately 20-100 millimeters when the longitudinal absorbent segments **51, 52** are spaced apart. Conversely, when the longitudinal absorbent segments **51, 52** are subjected to lateral forces by the user's legs and pushed together, the flexible zone **54** easily folds upon itself, for example in an accordion-like fashion, to occupy minimal width in the absorbent core **50.** In a particular embodiment, the absorbent article **10** may be manufactured, packaged, and shipped with the flexible zone **54** in a compressed state such that the flexible zone **54** occupies a minimum width between the longitudinal absorbent segments **51**, **52**. Prior to use, the wearer removes the absorbent article **10** from the package and rolls, kneads, pulls, stretches, or otherwise manipulates the absorbent article **10** to separate the longitudinal absorbent segments **51**, **52** and extend the flexible zone **54** to an uncompressed width.

The length of the flexible zone **54** varies according to the particular embodiment and intended use for the absorbent article **10**. In general, the flexible zone **54** exists beneath the user's genitalia or crotch area and extends approximately 20-140 millimeters in length along the longitudinal axis **X**, terminating at or near the transverse absorbent segment **56**. The termination of the flexible zone **54** may be rounded, as shown in Figures 1 and 2A. Alternately, the flexible zone **54** may terminate in a square shape or taper to a point. In particular embodiments, as shown in Figures 3-5, the flexible zone **54** may extend forward and/or rearward along the length of the absorbent article **10**.

The flexible zone **54** may also include a surfactant to further minimize absorbency in the flexible zone **54.** In alternate embodiments,

the flexible zone **54** may include superabsorbent material to provide a thin, lightweight, and flexible absorbent capacity. However, certain structure, additives, or coatings in the flexible zone **54** that could reduce the flexibility, suppleness, or resilience of the flexible zone **54** should be avoided. For example, if an adhesive is used to attach the absorbent core **50** to the cover **20** and/or baffle **40**, as previously described, the adhesive should not extend into the flexible zone **54**. Similarly, if the garment-facing side of the baffle **40** includes adhesive strips for adhering the absorbent article **10** to the user's undergarment, the adhesive strips should not coincide with the location of the flexible zone **54**.

Physically, the flexible zone **54** may simply be an extension of the cover **20,** an extension of the baffle **40,** a combination of the cover **20** and baffle **40,** or it may comprise a thin, separate, minimally absorbent sheet between the cover **20** and baffle **40**. One example of a thin, separate, minimally absorbent sheet is a tissue or non-woven web, such as that marketed under the name SONTARA. In particular embodiments, the flexible zone **54** may comprise a collection of free flowing particles. As used herein, the term "free flowing" refers to the ability of the particles to readily move in response to shear forces typically encountered in the use of the absorbent article **10**. Examples of free flowing particles include low density foam, polymethylurea (PMU) particles, fiber flakes, and fiber bundles.

The flexible zone **54** combines with the longitudinal absorbent segments **51, 52** in the absorbent core **50** to improve the overall coverage, capacity, visual discretion, and comfort of the absorbent article **10.** When the flexible zone **54** is extended, as shown in Figure 2A, the longitudinal absorbent segments **51, 52** can move with the user's legs to improve comfort, and the combined width of the flexible zone **54** (approximately 20-100 millimeters) and the longitudinal absorbent segments **51, 52** (approximately 10-50 millimeters) covers an effective width of up to 150 millimeters. When the user's legs compress the flexible zone **54,** as shown in Figure 2B, the reduced width of the absorbent core **50** remains comfortable and continues to provide full coverage with little or no

deformation or twisting, there by creating a situation for maximum absorbent efficiency.

Figures 3 through 5 illustrate alternate embodiments of absorbent cores within the scope of the present invention. The cover and optional transfer layer described in the previous embodiment have been cut away from each figure to better illustrate the absorbent core in each embodiment.

Referring to Figure 3, an alternate embodiment of an absorbent core **60** again includes two longitudinal absorbent segments **61, 62** separated by a flexible zone **64.** In this embodiment, however, the flexible zone **64** simply comprises the previously described baffle **40.** In addition, the absorbent core **60** does not include a transverse absorbent segment at either end of the absorbent article **10.** Instead, the longitudinal absorbent segments **61, 62** curve inwardly from either end of the absorbent article **10** so that the flexible zone **64** at either end is wider at the ends than at the center. For example, the flexible zone **64** may be approximately 10-20 millimeters wide at the center and over 40 millimeters wide at either end. A further embodiment may reverse the curvature of the longitudinal absorbent segments **61, 62** to provide a flexible zone **64** that is wider at the center than at either end.

Referring to Figure 4, an absorbent core **70** in this embodiment includes a third rectangle-shaped longitudinal absorbent segment **73** located between two peanut-shaped longitudinal absorbent segments **71, 72.** The third absorbent segment **73** is generally a smaller, thinner version of the other two absorbent segments **71, 72** and provides the absorbent article **10** with additional fluid coverage and capacity. In addition, all three longitudinal absorbent segments **71, 72, 73** include transfer splits **78** to increase flexibility and conformity with the user's body. This embodiment may be preferable when the user anticipates extended periods of walking or standing, extended periods between changing absorbent articles, or periods of especially heavy flows of exudates.

Referring to Figure 5, an absorbent core **80** includes two longitudinal absorbent segments **81, 82** separated by a plurality of

transverse flexible strips **84.** The transverse flexible strips **84** comprise the same material, provide the identical functions, and occupy the flexible zone described in earlier embodiments. The transverse flexible strips **84** may attach to the longitudinal absorbent segments **81, 82** and/or the cover (not shown) and/or the baffle **40** to enhance structural integrity.

It will be appreciated that the foregoing examples, given for purposes of illustration, are not to be construed as limiting the scope of this invention. Although only a few exemplary embodiments of this invention have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention, which is defined in the following claims and all equivalents thereto. Further, it is recognized that many embodiments may be conceived that do not achieve all of the advantages of some embodiments, yet the absence of a particular advantage shall not be construed to necessarily mean that such an embodiment is outside the scope of the present invention.